NASA Activities

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About the Cover

Flight testing of a NASA/Army Rotor System Research Aircraft (RSRA) in its fixed-wing configuration began May 8 at Ames Research Center's Dryden Flight Research Facility in Edwards, Calif.

Purpose of the tests is to demonstrate the fixed-wing capability of this helicopter/airplane hybrid research vehicle and explore its flight envelope and flying qualities in preparation for the NASA/DARPA RSRA/X-Wing Rotor flight test program.

The two NASA/Army RSRA are unique research vehicles, designed to provide a facility for inflight investigation and verification of new helicopter rotor system concepts and supporting technology. The RSRA can be configured to fly as a helicopter, as a compound helicopter (with fixed wings and auxiliary jet engines) or as an airplane. This is the first time the RSRA has flown in the airplane mode.

The fixed-wing flight evaluation will be conducted in two phases. In the first phase the RSRA is equipped with its tail rotor, but no main rotor, with test speeds limited to 250 knots, while the planned second phase will be completely rotorless for higher flight speeds. The aircraft will be tested at altitudes up to 10,000 feet.

Both phases will include taxi tests, investigations of takeoff and landing techniques, acoustics tests, envelope development and determination of control power (the effects control inputs have on aircraft and dynamic stability). Additionally, the first phase will investigate level flight performance with and without the main rotor hub.

Contents

Administrator's Column 3
NASA Transfers Ownership of Viking Lander 1 to Museum 4
Shuttle Mission 41-D—Pre-Launch Statistics..... 5
Dr. Hans Mark Named to University of Texas Post . 7
Productivity Conference Held at Marshall..... 7
NASA Signs Agreement With Israel for Earthquake Study 8
Earth Observation Mission Payload Specialists Named 9
H. William Wood Named to Tracking Networks Post..... 9
NASA Selects 17 Astronaut Candidates 10
Plasma Physics Experiments Continued at Wallops . 11
Astronaut Hart Leaves NASA 12
Fine Guidance Sensors Tested 12
ESP—NASA's Renewed Suggestion Program..... 12
Patents for Inventions from NASA Research 14
Deere & Company Designing Metallurgical Tests Aboard Shuttle..... 15
Contractor News 16
What's New in NASA Television and Radio Programming 17
1984 Launch Activity 18
Another Dividend from Air and Space 20

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Administrator's Column

(In this column NASA Activities features an article by NASA Administrator James M. Beggs. These articles focus on subjects chosen by him that address topics of broad interest to the agency's employees. The columns this month features an address presented to employees and guests at the Headquarters Honors Awards Ceremony held June 12 in Washington, D.C.)

A Year to Remember

Events like this are always happy occasions for the NASA family, and this one is no exception.

There is an old Japanese proverb that says "Many words, little sense." I'm going to take that hint today. My words will be brief. And I hope they make some sense.

First, let me congratulate you all. This has been a year of fantastic success for NASA, and you have all helped to make it so. Let me thank you for hewing to the traditional NASA standard of excellence in all you do. I look forward to hearing more about your individual contributions later on.

G.K. Chesterton, the English essayist, once wrote that we are kept going in life by the notion of something around the corner. Certainly that has been true of NASA throughout its history. But, over the past 12 months, we have passed so many milestone that we have stopped counting corners.

There is a tendency around NASA to speak in terms of programs, or, forgive the pun, more cosmically, in terms of eras, rather than years. In our agency's relatively short lifetime, we have known the Apollo era and the pre- and post-Apollo eras. Now we are in the Shuttle era, and soon, will be moving into the Space Station era.

The habit of telescoping events in this way, of course, gives us a good perspective on our achievements. And, because there is great continuity in our work, or, perhaps, because we enjoy what we do so much, the highlights of any particular year tend to become blurred.

A ceremony like this one, though, gives us a chance to look back on the year and to place events in a somewhat different perspective. And what a year it has been!

There was our 25th Anniversary celebration at the Air and Space Museum with President Reagan in attendance. There was the successful tour of the Shuttle orbiter Enterprise through Europe and the remarkable turnout of millions who cheered her.

There was the Spacelab mission, our largest joint international cooperative project, and its many scientific and technological milestones.

There were the many firsts and they were truly historic. Among them were the first ascent of an American woman, Sally Ride, into space; and the first ascent of a black American, Guy Bluford; the first flight of payload specialists, one of whom, Ulf Merbold, became the first non-American to fly on the Shuttle. And we saw the first American spacewalk in nine years when Mission Specialist Don Peterson and Story Musgrave left the crew compartment and drifted into the Shuttle cargo bay to test tools and equipment.

We also saw the first night launch and landing of the Shuttle and its first landing at the Kennedy Space Center. Bob Crippen became the first man to fly in a Shuttle three times. And I'm happy to say he's scheduled for his fourth mission later this year.

The rescues of TDRSS and of the Solar Max satellite—one from the ground, the other from space—were extremely significant, not only from the programmatic and cost-saving point of view, but also because they reinforced the public image of NASA as a "can-do" agency, and that's extremely important for our future.

That future looks bright, indeed.

We continue to provide the first-rate research base and stimulus for American aviation. Our advanced turbo-prop program, promising jet-like speed, but with fuel savings of up to 30 per cent, is moving into its ground-test stage. Our laminar flow control technology also promises considerable fuel savings and is being readied for flight testing. We have put into initial operation our new Transonic Facility, which gives us a significant advance in ground-based research capability. The NTF, coupled with the Numerical Aerodynamic Simulation capability, on which we are moving forward, will give the United States the world's two premier aeronautical R&D facilities and help us maintain our aeronautical leadership, which is so vital to the nation.

We continue our search for new knowledge of our solar system, the galaxies and the universe. Our orbiting observatories, free from the atmosphere's obscuring effects, are continuing to unlock the mysteries, visible and invisible of the universe.

And we are preparing for a permanent manned presence in space—a base from which we will be able to extend our activities and do all of the things we have been dreaming of doing over the past quarter century.

In his January State of the Union message the President directed NASA to develop a Space Station and to have it in operation within a decade. He also invited

our friends and allies to join with us in developing the station. And he called for a government-industry partnership to encourage private sector investment in space-based business.

As you know, we are making progress on all three elements of the President's initiatives. Following Congressional approval, we will be moving into the planning and definition phase of the Space Station. I am very optimistic that we will have some good news on the international front by the end of the year. And we are working closely with industry, not only the aerospace industry, to ease the way for space-based investments.

What do our achievements of the past 12 months add up to?

To me they indicate that our program has demonstrated great reliability and dependability and a new maturity. We do what we set out to do. And, moreover, we make it look easy.

NASA has more than justified its existence and the taxpayer's investment and faith in us. We are indeed, a true national asset. And we can be proud of it.

Much of our success is due to people like you, people whose dedication to excellence, however difficult the task, is the bedrock foundation of this agency's strength.

"The reward of a thing well done is to have done it," wrote Emerson. We have earned that reward manyfold. And I believe we can face the future with pride and with confidence as we prepare for the great challenges of tomorrow.

NASA Transfers Ownership of Viking Lander 1 To Museum

NASA transferred ownership of Viking Lander 1, which is on the planet Mars, to the Smithsonian's National Air and Space Museum in Washington, D.C., at ceremonies on May 18. This is the first time that a museum will have ownership of an object located on another planet.

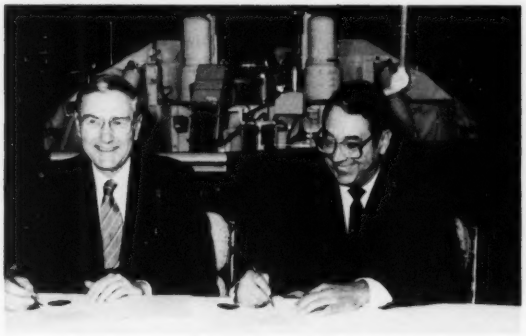
The transfer, requested by the Museum's Director Walter Boyne, also includes loaning the official Viking Lander plaque. This plaque renames the lander the Thomas A. Mutch Memorial Station, in memory of the Viking Lander Imaging Team Leader and NASA Associate Administrator for Space Science, who died in a climbing accident in the Himalayas in 1980.

The plaque is scheduled to be placed on the original lander on Mars by American astronauts when they travel to the "Red Planet" at some indefinite time in the future. NASA retains reclaimant rights of the lander for scientific purposes.

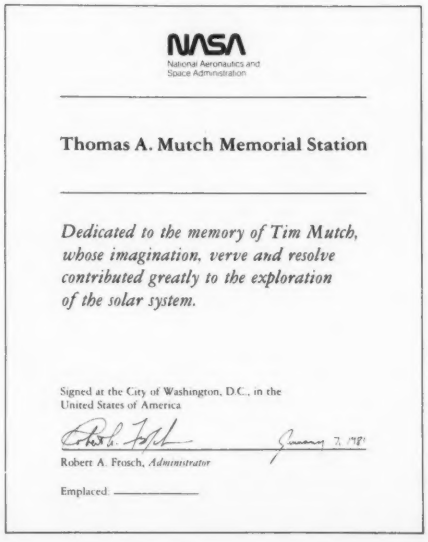
The Viking Landers set down on the surface of Mars in 1976, the first American spacecraft to provide close-up views from the surface of another planet.

The landers provided invaluable knowledge of Mars through weather observations and chemical and biological tests. More than 54,000 photographs were taken by the landers and orbiters, which circled overhead. The orbiters also monitored atmospheric water vapor and temperature from the planet.

The Viking mission highlighted the United States Planetary Exploration Program's goals to explore our solar system to obtain a better understanding of the origin and evolution of life and the physical processes that shape man's terrestrial environment.



James M. Beggs, NASA Administrator, and Walter Boyne, Director of the National Air and Space Museum, sign the official documents transfering ownership of NASA's Viking I Lander (depicted in the background).



NASA
National Aeronautics and Space Administration

Thomas A. Mutch Memorial Station

Dedicated to the memory of Tim Mutch, whose imagination, verve and resolve contributed greatly to the exploration of the solar system.

Signed at the City of Washington, D.C., in the United States of America

January 7, 1981

Robert A. Frosch, *Administrator*

Emplaced: _____

Shuttle Mission 41-D — Pre-Launch Statistics

Crew: Henry W. Hartsfield, Commander
Michael L. Coats, Pilot
Judith A. Resnik, Mission Specialist
Steven A. Hawley, Mission Specialist
Richard A. Mullane, Mission Specialist
Charles D. Walker, Payload Specialist

Orbiter: Discovery (OV-103)

Launch Site: Kennedy Space Center, Fla., Pad 39A

Launch Date/Time: June 25, 1984; 8:43 a.m. EDT*

Orbital Inclination: 28.5 degrees

Altitude: 173 nautical miles

Mission Duration: 7 days, 47 minutes MET*
112 full orbits; land on 113th

Landing Date/Time: July 2, 1984; 9:35 a.m. EDT*

Primary Landing Site: Edwards Air Force Base, Calif.

Payloads: Continuous Flow Electrophoresis System
Large Format Camera
OAST-1 (Office of Aeronautics & Space Technology)
Syncom IV
Cinema 360 (payload bay)
IMAX (cabin)
Student Experiment — Float Zone Recrystallization in Zero-G

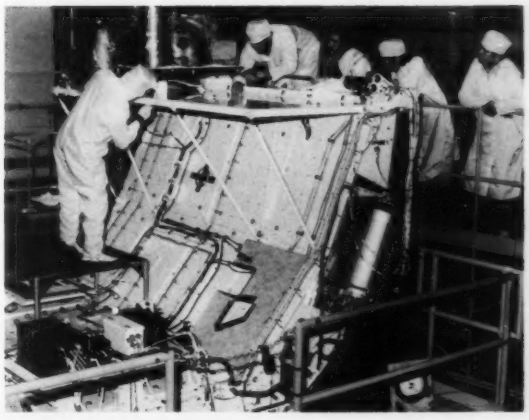
Mission Firsts:
First flight of Discovery
First commercial payload specialist
First use of Large Format Camera
First flight of OAST payload
First "frisbee" deployment — Syncom IV

*Subject to change; mission elapsed times are approximate.

Principal Mission Activity: A new phase in the CFES program will be introduced with the first use of the Block Three hardware and the first commercial payload specialist to operate it. Designed for mass production operation, Block Three eliminates the use of collection trays and sample syringes and is totally self-contained. The CFES will process on sample at greater quantities than before.

The Large Format Camera is a precision cartographic camera located on the Mission Peculiar Experiment Support Structure (MPESS) in the payload bay. The LFC will acquire high resolution photography of the earth's surface. The LFC features a film format of 9 × 8 inches, a focal length of 12 inches and a thin-base film capacity of 4,000 feet (approximately 2,400 frames). Operation of the LFC will be controlled by the ground and occur throughout the flight.

The OAST-1 is a NASA-owned and operated payload that consists of three solar experiments mounted on a support structure. The experiments include: Solar Array Experiment, an extendable solar array wing with the capability of extending about 100 feet; Dynamic Augmentation Experiment, a structure containing sensor and electronic packages; and the Solar Cell Calibration Facility, a self-contained, data acquisition and storage package.



Technicians check out the OAST-1 payload for flight 41-D.

Syncom IV, a communications satellite, is designed by Hughes Communications Services, Inc., and leased to the U.S. Navy. The satellite will roll up and out of the payload bay in what has been called a "frisbee" deploy. The crew initiates deployment by retracting several detachment pins and firing a spring release clamp on the port side of the Syncom cradle. Pivoting on two starboard attach points, the satellite will roll up and out of the payload bay. Syncom will be the first to be boosted to its parking orbit by a Unique Upper Stage. This stage is actually a modified Minuteman-3 solid rocket booster and is an integral part of the satellite.

The student experiment, "Float Zone Recrystallization in Zero-G," is designed to compare a crystal grown by the Float Zone technique in a low gravity environment to a crystal grown in an identical manner on earth. The Float Zone technique uses an infrared heater which translates along a gallium rod. The area of the rod effected by the heater is called the "float zone" and it is here that recrystallization takes place. The experiment will be filmed and all of the data will be analyzed after the mission.

Summary of Major Activities

Flight Day 1

CFES Activation
Large Format Camera
IMAX camera
Cinema 360 camera

Flight Day 2

Syncom deployment
Large Format Camera
Cinema 360 camera

Flight Day 3

OAST-1 operations
Large Format Camera
Cinema 360 camera

Flight Day 4

OAST-1 operations
Large Format Camera
Radiation Monitoring Equipment

Flight Day 5

OAST-1 operations
Large Format Camera
Radiation Monitoring Equipment

Flight Day 6

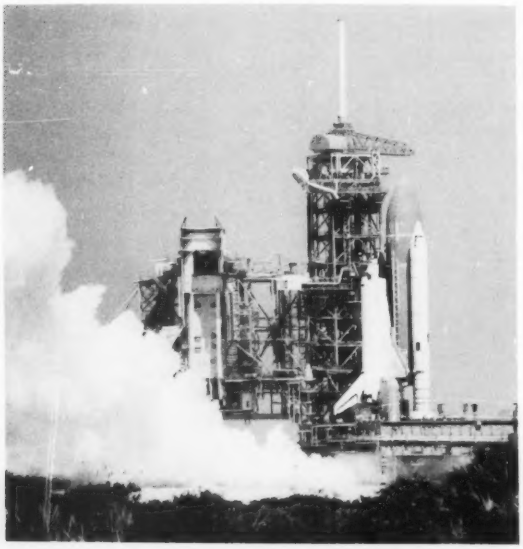
OAST-1 operations
Large Format Camera
Student Experiment
CFES Closeout
IMAX camera
Radiation Monitoring Equipment

Flight Day 7

Large Format Camera
Radiation Monitoring Equipment

Flight Day 8

Landing



The three main engines of the Orbiter Discovery roared to life for a 20-second test firing on June 2.

Dr. Hans Mark Named to University of Texas Post

Dr. Hans M. Mark, NASA Deputy Administrator, has been named Chancellor of the University of Texas System, effective Sept. 1.

Mark became Deputy Administrator of NASA in July 1981; previously was Secretary of the Air Force from July 1979 until February 1981; and Under Secretary of the Air Force since 1977.

Mark's appointment was announced during a special meeting of the University of Texas System Board of Regents in Austin today.

A nuclear physicist, Mark's career has included a broad range of academic, administrative and research assignments.

In announcing the appointment, Texas Board Chairman Jon Newton said of Mark: "With his Air Force and NASA background, he has demonstrated the management ability to administer effectively a complex organizational enterprise such as the U. T. System, which involves 119,000 students, 50,000 faculty and staff and an operational budget for Fiscal Year 1984-85 of $1.8 billion. The University of Texas system is a diverse system of universities and health-science institutions, including seven academic campuses, six health-related institutions and the Institute of Texas Cultures.

Mark was born in Mannheim, Germany, June 17, 1929. He came to the United States in 1940 and became a citizen in 1945. He received his bachelor's degree in physics from the University of California at Berkeley in 1951 and his doctorate in physics from the Massachusetts Institute of Technology in 1954.

In February 1969, Mark became director of NASA's Ames Research Center, Mountain View, Calif., where he managed the center's research and applications efforts in aeronautics, space science, life science and space technology.

He has taught undergraduate and graduate courses in physics and engineering at Boston University, Massachusetts Institute of Technology and the University of California at both the Berkeley and Davis campuses.

Following completion of graduate studies, Mark remained at MIT as a research associate and acting head of the Neutron Physics Group, Laboratory for Nuclear Science, until 1955. He then returned to the University of California at Berkeley as a research physicist at the University's Lawrence Radiation Laboratory in Livermore until 1958.

He subsequently served as an assistant professor of physics at MIT before returning to the University of California's Livermore Radiation Laboratory's Experimental Physics Division from 1960 to 1964. He then became chairman of the university's Department of Nuclear Engineering and administrator of the Berkeley Research Reactor until joining NASA at Ames.

Mark has served as a consultant to government, industry and business, including the Institute for Defense Analyses and the President's Advisory Group on Science and Technology.

He has authorized many articles for professional and technical journals. He co-authored the books "Experiments in Modern Physics" and "Power and Security" and co-edited "The Properties of Matter under Unusual Conditions."

Mark is a member of Tau Beta Pi, Sigma Xi, Phi Beta Kappa and the National Academy of Engineering. He is a fellow of the American Physical Society and the American Institute of Aeronautics and Astronautics. He is a member of a number of other professional organizations including the American Nuclear Society, the American Geophysical Union, the American Association of University Professors and the Society for Engineering Science. He holds an honorary doctor of science awarded in 1978 by Florida Institute of Technology and an honorary doctor of engineering awarded in 1982 by the Polytechnic Institute of New York.

Productivity Conference Held at Marshall

Recommendations for improving productivity and quality in NASA's programs with American industry were presented and discussed recently during a NASA/contractor conference on impediments to productivity held April 26-27 at Marshall Space Flight Center in Huntsville, Ala. The conference was attended by representatives from approximately 35 agency contractors and all NASA centers.

NASA Administrator James M. Beggs strongly stated the need for greater productivity and higher quality in order to recoup from a steady decline in U.S. research and development allocations and a decline in the

country's world-wide market position due to the impact of Japanese and German productivity improvements and quality enhancements over the last 10 to 20 years.

Beggs said a modest growth of one percent in the NASA budget over inflation is expected during the next five years. "It puts emphasis on our ability to do our job more efficiently, more productively and concomitantly with that productivity, with higher quality because it is quality to a large extent that drives our costs.

"It is, therefore, incumbent upon us to eliminate any 'impediment' at the NASA/contractor interface which would prevent us from being more productive," he said.

Ninety cents of every NASA dollar is spent with industry and universities, according to Beggs, "making it encumbent upon us to be more productive," he said. An estimated 85 percent of the agency's fiscal year 1984 annual budget of $7.2 billion was placed with contractors.

The NASA administrator created one of the first productivity offices in a government research and development agency when he established the Productivity Improvement and Quality Enhancement program, or PIQE, 18 months ago. One of the first goals of the program was to include the NASA hardware and service/support contractors in the productivity effort.

Addressing the conference on the value of the NASA/contractor team effort, Marshall Center Director Dr. William R. Lucas said, "We have demonstrated a capability to go wherever in space we have a will to go, and to do whatever we commit ourselves to do."

Urging the agency and its contractor team to adopt a faster pace in the area of productivity improvement, Lucas said, "Doing much more with less is the challenge we face. Finding ways to accomplish this goal will enable us to continue to meet our obligations to the American taxpayer to prudently administer the public funds with which we have been entrusted, and it's also the principal way that we'll be able to fully utilize the capability that has been developed."

Representatives of approximately 20 hardware and service/support contractors participated in three workshop sessions in 1983 to identify areas of quality and productivity improvement. Contractors and NASA personnel were then organized into task teams to review the areas identified as possibilities for increasing productivity.

NASA Signs Agreement With Israel for Earthquake Study

The origin of earthquakes in the Mediterranean region will be the subject of a study by NASA and the Israeli Space Agency.

Focus of the program will be the precise determination of very small movements of the earth's crust. Key to understanding the crustal movements lies in the measurement, over a period of years, of precise relative positions of scientific base stations.

Israel will join 11 other countries conducting laser ranging activities with NASA in 20 locations. This global network will significantly enhance study and understanding of the solid earth and its dynamic processes.

The Israeli Space Agency will build a ground station in Israel and install laser, optical and electronic equipment on long-term loan from NASA. This equipment is used to measure the distance between ground stations and specially equipped satellites.

A short, low-power, laser pulse is beamed to the satellite, which reflects the light back to the station. Travel time of the pulse is measured to determine the distance to the satellite. When two or more stations track the same satellite, the distance between the stations can be measured accurately. By acquiring data over a period of time, any change in distance can be determined, representing crustal movement between the stations.

The Israeli station will be transmitting to such satellites as NASA's Laser Geodynamics Satellite, LAGEOS, and the French Satellite Starlette. Both are specially equipped with optical corner cube retroreflectors.

Fixed stations, such as the one in Israel, can also work with mobile laser tracking stations to map regional patterns of crustal deformation and to monitor strain accumulation. The Israeli station will be part of a worldwide network including fixed and mobile stations in the Mediterranean area expected to begin measuring crustal movements under this program in 1985.

Other countries in Europe and North Africa, including France, the United Kingdom, the Federal Republic of Germany, the Netherlands, Sweden, Switzerland and Italy, will be involved in the cooperative research program.

The crustal dynamics project at Goddard Space Flight Center, Greenbelt, Md., will manage the United States/Israeli effort. The Israeli Space Agency will be responsible for the operation of the Israeli station.

Earth Observation Mission Payload Specialists Named

NASA has announced the selection of Dr. Michael Lampton of the University of California at Berkeley and Dr. Byron Lichtenberg of the Massachusetts Institute of Technology to fly as payload specialists on the first Earth Observation Mission, scheduled for launch aboard the Space Shuttle in 1985.

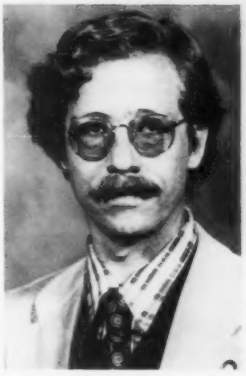
EOM 1, as the mission is officially designated, is the first in a series of NASA Spacelab missions primarily dedicated to measuring the makeup of the earth's middle and upper atmosphere and variations in the sun's output during an 11-year solar cycle. To accomplish this, several of the instruments originally carried on the Spacelab 1 mission in November 1983 will be reflown. The Earth Observation Mission series is being managed by the Marshall Space Flight Center in Huntsville, Ala.

Lichtenberg, who flew as a payload specialist on the historic first Spacelab mission late last year, and Lampton, who was an alternate payload specialist for that mission, were selected by the group of scientists who will have experiments aboard the Earth Observation Mission. Selection occurred during the first meeting of the Investigator Working Group at the Marshall Center in March. The pilots and mission specialists will be assigned by NASA later.

"The selection of Lichtenberg and Lampton capitalizes on the prior training of each crewmember on each of the investigations and on the proven professional and operational qualifications of both men," said Mission Manager Gary Wicks of the Marshall Center. "This is important because of the considerable training required in the short time before flight."

The first Earth Observation Mission is currently scheduled to carry nine experiments in three major areas of research — space plasma physics, astronomy and solar physics, and atmospheric physics and earth observations. NASA is sponsoring the Atmospheric Emission Photometric Imaging, Active Cavity Radiometer, Imaging Spectrometric Observatory and Far Ultraviolet Astronomy using the FAUST telescope.

The Belgian space agency is sponsoring the Measurement of the Solar Constant and, together with the French space agency, is sponsoring the Grille Spectrometer. The French space agency is also sponsoring the Solar Spectrum from 170-3200 Nanometers. The Japanese space agency is sponsoring Space Experiments with Particle Accelerators (SEPAC). The German space agency is sponsoring the Metric Camera. The European Space Agency is providing support to the European investigations.



Michael Lampton

Byron K. Lichtenberg

This NASA Spacelab mission will use the short version of the laboratory module, in which the scientists will work, and a single pallet, which will hold instruments that need to be exposed directly to the space environment. The crew will live in the Space Shuttle orbiter and travel to and from work in the laboratory module through a Spacelab transfer tunnel.

H. William Wood Named to Tracking Networks Post

H. William Wood has been appointed Deputy Associate Administrator (Networks), Office of Space Tracking and Data Systems, NASA Headquarters.

In this position, he is responsible for planning, directing, executing and evaluating the Network Programs within the Office of Space Tracking and Data Systems.

Wood was the Director, Network Systems Division from 1981 to this appointment. He was a research engineer at the NACA's Langley Research Center when NASA was formed in 1958. In 1959, he was assigned as a Group Leader with the Tracking and Ground Instrumentation unit for the Mercury Network. Wood's most recent assignments have been Associate Director, Network Systems Division, and before that the NASA Senior Scientific Representative in Australia and Associate Director, Operations, in the Network Directorate at the Goddard Space Flight Center. Prior to his work at NACA, Wood served several years in the U.S Air Force.

NASA Selects 17 Astronaut Candidates

NASA has announced 17 astronaut candidates for the Space Shuttle program.

Seven are pilot astronaut candidates and 10 are mission specialist astronaut candidates. They will report to NASA's Johnson Space Center, Houston, this summer to begin a yearlong program of training and evaluation. Successful candidates will then begin training assignments leading to selection for Space Shuttle flight crews.

Three of the mission specialist candidates are women and one pilot candidate is Hispanic. Four of the mission specialists are currently employed at the Johnson Space Center, and one is employed by NASA's Jet Propulsion Laboratory, Pasadena, Calif.

NASA received 4,934 applications and 128 applicants were interviewed and given medical examinations at Johnson.

A list of candidates and their biographical data follows. Data, in order, includes name, birth place and date, current residence, education, present position and parents.

James C. Adamson, Major, U.S. Army; March 3, 1946, Warsaw, N.Y.; Seabrook, Texas; Geneseo Central High School, N.Y., bachelor's degree in engineering, U.S. Military Academy, 1969 and master's in aeronautics and mechanical engineering, Princeton University, 1977; Flight Controller, Systems Division, Johnson Space Center, Houston; Mr. and Mrs. Herman Adamson, Geneseo, N.Y.

Mark H. Brown, Capt., U.S. Air Force; Nov. 18, 1951, Valparaiso, Ind.; Pearland, Texas; Valparaiso High School, Ind., bachelor's degree in aeronautical and astronautical engineering, Purdue University, 1973, master's in astronautical engineering, Air Force Institute of Technology, 1980; Pilot, F-4 Replacement Training Unit, Homestead AFB, Fla.; Mr. and Mrs. Richard S. Brown, Valparaiso, Ind.

Kenneth D. Cameron, Major, U.S. Marine Corps; Nov. 29, 1949, Cleveland, Ohio; Patuxent River, Md.; Rocky River High School, Rocky River, Ohio, bachelor's and master's degrees in aeronautics and astronautics, Massachusetts Institute of Technology, 1978 and 1979; Project Officer, Marine Aviation Detachment, Naval Air Test Center, Patuxent River, Md.; Mr. and Mrs. Donald B. Cameron, Westport, Conn.

Manley L. Carter, Jr., Comdr., U.S. Navy; Aug. 15, 1947, Macon Ga.; California, Md.; Lanier High School, Macon, Ga., bachelor's degree in chemistry, Emory University, 1969 and doctor of medicine degree, Emory University, 1973; Test Pilot Under Instruction, Naval Air Test Center, Patuxent River, Md.; Mr. and Mrs. Manley L. Carter Sr., Warner Robins, Ga.

John H. Casper, Lt. Col., U.S. Air Force; July 9, 1943, Greenville, S.C.; Alexandria, Va.; Chamblee High School, Ga., bachelor's degree in astronautics and engineering science, U.S. Air Force Academy, 1966, master's in astronautics, Purdue University, 1967; Deputy Chief, Special Projects Office, Headquarters, U.S. Air Force, Washington, D.C.; Mr. and Mrs. John Casper, Gainesville, Ga.

Frank L. Culbertson, Jr., Lt. Comdr., U.S. Navy; May 15, 1949, Charleston, S.C.; Lexington Park, Md.; Holly Hill High School, S.C., bachelor's degree in aerospace engineering, U.S. Naval Academy, 1971; Naval Aviation, F-14 Replacement Air Group, Naval Air Station Oceana, Va.; Dr. and Mrs. Frank L. Culbertson Sr., Holly Hill, S.C.

Sidney M. Gutierrez, Capt., U.S. Air Force; June 27, 1951, Albuquerque, N.M.; Edwards, Calif.; Valley High School, Albuquerque, N.M., bachelor's degree in aerospace engineering, U.S. Air Force Academy, 1973, master's in management, Webster College, 1977; Test Pilot, Air Force Flight Test Center, Edwards AFB, Calif.; Mr. and Mrs. Robert A. Gutierrez, Albuquerque, N.M.

Lloyd B. Hammond Jr., Capt., U.S. Air Force; Jan. 16, 1952, Savannah, Ga.; Edwards, Calif.; Kirkwood High School, Miss., bachelor's degree in engineering mechanics, U.S. Air Force Academy, 1973 and master's, Georgia Institute of Technology, 1974; Instructor Pilot, USAF Test Pilot School, Edwards AFB, Calif.; Mr. and Mrs. Lloyd B. Hammond Sr., Lutz, Fla.

Marsha S. Ivins, April 15, 1951, Baltimore, Md.; Webster, Texas; Nether Providence High School, Wallingford, Pa., and bachelor's degree in aerospace engineering, University of Colorado, 1973; Flight Simulation Engineer, Aircraft Operations Division, Johnson Space Center, Houston; Mr. and Mrs. Joseph L. Ivins, Wallingford, Pa.

Mark C. Lee, Capt., U.S. Air Force; Aug. 14, 1952, Viroqua, Wis.; Layton, Utah; Viroqua High School, Wis., bachelor's degree in civil engineering, U.S. Air Force Academy, 1974, and master's in mechanical engineering, Massachusetts Institute of Technology, 1980; F-16 Pilot, 388 Tactical Fighter Wing, Hill AFB, Utah; Mr. and Mrs. Charles M. Lee, Viroqua, Wis.

George D. Low; Feb. 19, 1956, Cleveland; Pasadena, Calif.; Langley High School, McLean, Va., bachelor's degree in physics, Washington & Lee University, 1978, bachelor's degree in mechanical

engineering, Cornell University, 1980, and master's in aeronautics and astronautics, Stanford University, 1983; Spacecraft System Engineer, Jet Propulsion Laboratory, Pasadena, Calif.; Mr. and Mrs. George M. Low, Troy, N.Y.

Michael J. McCulley, Lt. Comdr., U.S. Navy; Aug. 4, 1943, San Diego, Calif.; Virginia Beach, Va.; Livingston Academy, Tenn., bachelor's and master's degrees in metallurgical engineering, Purdue University, 1970; Operations Officer, Attack Squadron Thirty-Five, USS Nimitz, Naval Air Station Oceana, Va.; Mr. and Mrs. Gibson H. McCulley, both deceased.

William M. Shepherd, Lt. Comdr., U.S. Navy; July 26, 1949, Oak Ridge, Tenn.; Virginia Beach, Va.; Arcadia High School, Scottsdale, Ariz., bachelor's degree in aerospace engineering, U.S. Naval Academy 1971, master's degrees in mechanical engineering and ocean engineering, both from Massachusetts Institute of Technology, 1978; Commanding Officer, Special Boat Unit TWENTY, Naval Amphibious Base, Little Creek, Va.; father, the late George R. Shepherd and mother, Barbara Shepherd, Bethesda, Md.

Ellen L. Shulman, M.D., April 27, 1953, Fayetteville, N.C.; Houston; Bayside High School, New York, N.Y., bachelor's degree in geology, State University of New York at Buffalo, 1974 and doctor of medicine at Cornell University, 1978; Medical Officer, Medical Sciences Division, Johnson Space Center, Houston; Dr. and Melvin Shulman, Beechhurst, N.Y.

Kathryn C. Thornton, PhD; Aug. 17, 1952, Montgomery, Ala.; Charlottesville, Va.; Sidney Lanier High School, Montgomery, Ala., bachelor's degree in physics, Auburn University, 1974, master's and doctorate, both in physics, University of Virginia, 1977 and 1979; Physicist, U.S. Army Foreign Science & Technology Center, Charlottesville, Va.; William C. Cordell, Hope Hull, Ala. and the late Elsie Cordell.

Charles L. Veach; Sept. 18, 1944, Chicago; Houston; Punahou School, Honolulu, Hawaii, and bachelor's degree in engineering management, U.S. Air Force Academy, 1966; Aerospace Engineer & Pilot, Aircraft Operations Division, Johnson Space Center, Houston; Mr. and Mrs. Marshall E. Veach, Honolulu, Hawaii.

James D. Wetherbee, Lt., U.S. Navy; Nov. 27, 1952, Flushing, N.Y.; Lemoore, Calif.; Holy Family Diocesan High School, South Huntington, N.Y., and bachelor's degree in aerospace engineering, University of Notre Dame, 1974; Test Pilot, Naval Air Station Lemoore, Calif.; Mr. and Mrs. Dana A. Wetherbee, Huntington Station, N.Y.

Plasma Physics Experiments Continued at Wallops

A two-stage sounding rocket was successfully launched on May 10 from Virginia's Eastern Shore to conduct a wave-plasma experiment in the earth's upper atmosphere.

The primary objective of the flight is to study magnetospheric plasma/wave particle instabilities induced by ground-produced VLF radiowaves produced in the troposphere — 12 miles up to 62 miles. The source of these waves was a high intensity transmitter located in Annapolis, Md., operated by the Navy.

This experiment, and similar tests conducted during the past several years, are designed to further our knowledge about the near-earth environment.

Liftoff of the Nike-Orion sounding rocket occurred at 4:57 a.m. EDT. The 500-pound payload reached a peak altitude of 52 statute miles. The Nike-Orion is about 30 feet long and 17 inches in diameter.

Rocket instrumentation included a VLF receiver, geiger counter, x-ray detector, a Gerdien probe, electric field sensors and a two axis magnetometer. The payload was programmed to descend on a parachute to increase sampling time on a stable platform in the critical region of interest.

Gene Guerny, Chief, Public Affairs, Goddard Space Flight Center, was the winner of the 1983 Aviation/Space Writers Association (AWA) Public Affairs Officer of the Year Award. Guerny was recognized for his accomplishments in bringing fast breaking news to the public through the media conferences he conducted at Goddard. These outstanding media conferences were for the Tracking and Data Relay Satellite, the Explorer (ISEE-3) Satellite and the Search and Rescue Satellite. Guerny (left), is shown receiving the award from Award Chairman Jim Crandall of Honeywell, Inc.

Astronaut Hart Leaves NASA

Astronaut Terry J. Hart, who operated the Space Shuttle's mechanical arm to retrieve the Solar Maximum Mission satellite on the recent spacecraft repair mission, left NASA on June 15 to return to private industry.

Hart, 37, will work in an engineering management position for the newly formed Military and Government Systems Division of Bell Laboratories in Whippany, N.J. That division will produce large digital communications networks for government applications.

Hart was named a NASA astronaut candidate in January 1978 and in August 1979, he completed the training and evaluation period.

He served as Capcom in Mission Control for Shuttle missions 1, 2, 3 and 7. His only space flight was STS 41-C, April 6-13, 1984.

Hart received his bachelor's degree in mechanical engineering from Lehigh University in 1968, a master's degree in mechanical engineering from the Massachusetts Institute of Technology in 1969 and a master of science degree in electrical engineering from Rutgers University in 1978.

He entered active service with the Air Force Reserve in June 1969 and logged more than 3,000 hours flying time.

A native of Pittsburgh, Pa., Hart is married to the former Wendy Marie Eberhardt of Warren, Pa. They have two children.

Fine Guidance Sensors Tested

Tests of the Fine Guidance Sensors designed for the Edwin P. Hubble Space Telescope have demonstrated that the telescope will meet stringent pointing and tracking requirements, according to Jim Odom, manager of the Space Telescope Project at the Marshall Space Flight Center in Huntsville, Ala.

The telescope's three guidance sensors, built and tested for the Marshall Center at the Perkin-Elmer Corporation in Danbury, Conn., must enable the telescope to lock onto faint stars for periods of up to 24 hours with a tolerance of movement of only milliseconds of arc.

"This is equivalent to hitting a dime with a laser beam at a distance of 200 miles," Odom said.

For the scientific observations planned for the space telescope, a star or object to be studied must be adjacent to two other stars called "guide stars." These guide stars must meet stringent criteria such as brightness, color, adjacency and absence of stellar companions.

"Some of the most important observations planned can only be performed near the galactic pole — regions where only very dim guide stars may be available," Odom said. "The requirement for movement of only milliseconds of tolerance in the pointing accuracy of the Hubble telescope greatly exceeds that of the finest ground-based telescopes, such as the one at Mt. Palomar."

The Fine Guidance Sensors send control signals that identify tracking errors and assist in correcting them. During the tests, the two prime requirements for the sensors were to locate and lock onto a star and be able to utilize dim guide stars. The test results established that they will meet or exceed the requirements.

ESP — NASA'S Renewed Suggestion Program

NASA needs your ideas. These words are now appearing on posters throughout the agency. Improving NASA's productivity and quality of work are significant agency objectives. In May 1983, NASA established the Productivity Improvement and Quality Enhancement (PIQE) Program. As a part of the productivity improvement effort, the agency is taking another step: the renewal of the Employee Suggestion Program.

ESP is designed to encourage employees to think about ways to improve NASA and its operations. It recognizes and rewards employees, either individually or collectively, for ideas which directly contribute to productivity, economy and efficiency and directly increase effectiveness in carrying out NASA programs.

The Employee Suggestion Program is not new. It was established by Congress 30 years ago. In the 1960s NASA had an energetic suggestion program, but in the past decade it has fallen into disuse. In 1982, NASA received only 2.4 suggestions per 100 employees compared to a government-wide average of 5.6, an average of 32 for private industry and 60 to 70 for some well-organized company programs.

In October 1983, an agency-wide meeting was held at Goddard Space Flight Center in Greenbelt, Md., to review the elements of a successful program within government and private organizations and to determine

the characteristics necessary for a revitalized NASA program. Important areas identified were top-level management support, adequate resources to run a program, reasonable response time to suggesters and soliciting contractor ideas for savings.

In January 1984, NASA Administrator James M. Beggs issued a memorandum to Headquarters officials and center directors stating: "I believe that revitalizing the Employee Suggestion Program is another positive step to tapping the inherent capabilities of our staff for ideas to improve NASA's operations. I fully support giving this program the attention and resources necessary for NASA's Employee Suggestion Program to become the government's model."

Employee-generated ideas provide one of the greatest potential resources for increasing productivity. To submit a suggestion:

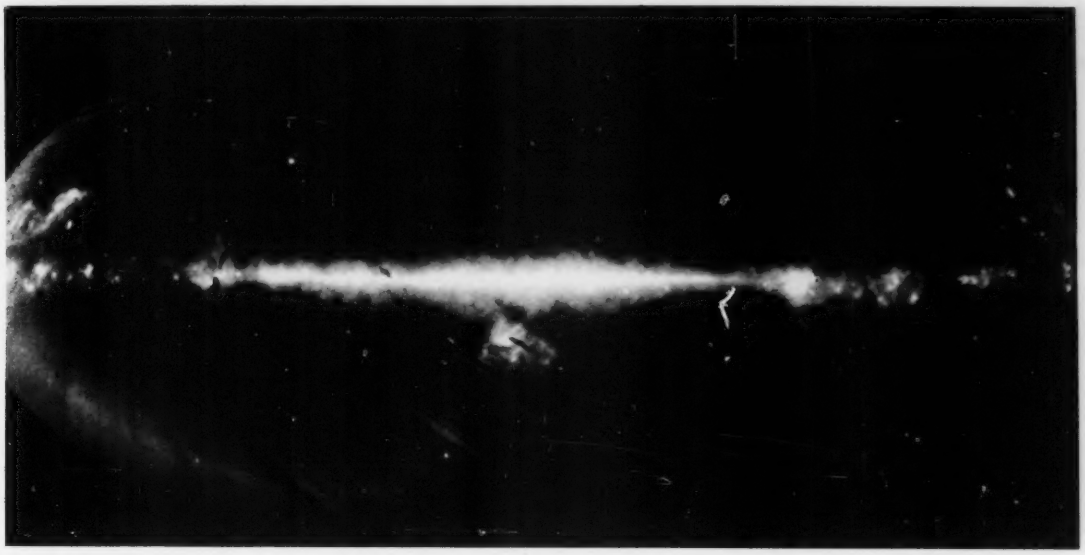
- Select a situation needing improvement
- Write it down
- Include all the facts
- Analyze these facts (ask why?)
- Identify possible solutions
- Select the most positive solution
- Submit the idea on the appropriate form to the installation personnel office

MILES OF WIRES—A technician assembles one of the extremely long wiring harnesses that will be installed in NASA's Hubble Space Telescope. The cables will be used for telescope power, command telemetry and data transmission. About 33 miles of cables were recently installed in the equipment section that will be part of the Telescope Support System Module. Assembling the Space Telescope requires installing, connecting and testing more than a ton of cable.

Patents for Inventions from NASA Research

The Office of General Counsel, NASA Headquarters, announces the following U.S. patents have been issued by the U.S. Patent Office and Trademark Office to NASA for inventions resulting from NASA research. Inquiries concerning them should be directed to the attention of the NASA Patent Counsel of the indicated installation.

Inventor(s) & Employer	Title	Patent No.	Installation
Allan J. Zuckerwar/NASA/LaRC	Acoustic ground impedance meter	4,445,378	LaRC
Michael A. Gedwill, Stanley R. Levine, Thomas K. Glasgow, NASA/LeRC	Overlay metallic-cermet alloy coating systems	4,446,199	LeRC
Gerhard A. Koepf, Phoenix Corp., McLean, Va.	Off-axis coherently pumped laser	4,446,556	GSFC
Richard O. Claus, Paul S. Zerwekh, Polytechnic Institute and State University, Blacksburg, Va.	Ultrasonic transducer with Gaussian radial pressure distribution	4,446,396	LaRC
Hollis H. Bond, Carl P. Franklin, Singer Co., Houston, Texas	Digital interface for bi-directional communication between a computer and a peripheral device	4,446,459	JSC
Frederick C. Hallberg, Clyde J. Morgan, NASA/GSFC	Workpiece positioning vise	4,448,406	GSFC
Robert M. Baucom, NASA/LaRC	Process of making medical clip	4,447,943	LaRC
Alan E. Lafever, Rockwell International, Downey, Calif.	Directional gear ratio transmissions	4,446,757	LaRC
Stanley A. Dunn, Alan R. Pomplun, Elmer G. Paquette, Bjorksten Research Labs, Madison Wis.; Edwin C. Etheridge, Jerry L. Johnson, NASA/MSFC	Sonic levitation apparatus	4,447,251	MSFC
Jag J. Singh, NASA/LaRC	Radionuculide counting technique for measuring wind velocity and direction	4,449,400	LaRC
Lloyd W. Ream, NASA/LeRC	Diesel engine catalytic combustor system	4,449,370	LeRC
M. Kudret Selcuk, Caltech/JPL, Pasadena, Calif.	Solar concentrator protective system	4,449,514	NRO/JPL
Walter H. Higa, Caltech/JPL, Pasadena, Calif.	Centrifugal-reciprocating compressor	4,449,894	NRO/JPL
Howard A. Zebker, Daniel N. Held, Richard M. Goldstein, Thomas C. Bickler, Caltech/JPL, Pasadena, Calif.	Synthetic aperture radar target simulator	4,450,447	NRO/JPL
John A. Parker, George M. Fohlen, NASA/ARC; Bappalige N. Achar, National Research Council, Washington, D.C.	Metal Phthalocyanine polymers	4,450,268	ARC
Michael A. Gedwill, Stanley R. Levine, Thomas K. Glasgow, NASA/LeRC	Coating with overlay metallic-cermet alloy systems	4,451,496	LeRC
William R. Marshall, NASA/MSFC	Three stage rocket vehicle with parallel staging	4,451,017	MSFC



NEARLY THE ENTIRE SKY, as seen in infrared wavelengths and projected at one-half degree resolution, is shown in this image, assembled from six months of data from the Infrared Astronomical Satellite (IRAS). The bright horizontal band is the plane of the Milky Way, with the center of the galaxy located in the center of the picture. The hazy, S-shaped feature that crosses the image is faint heat emitted by dust in the plane of the solar system. Celestial objects visible in the photo are regions of star formation in the constellations Ophiucus (directly above the galactic center) and Orion (the two brightest spots below the plane, far right). The Large Magellenic Cloud is the relatively isolated spot located below the plane, right of center. Black stripes are regions of the sky that were not scanned by the telescope in its first six months of operation. IRAS is a joint project of the United States, the Netherlands and the United Kingdom.

Deere & Company Designing Metallurgical Tests Aboard Shuttle

NASA and Deere & Company of Moline, Ill., have signed a memorandum of understanding to cooperate on the design of metallurgical tests to be conducted aboard a future Space Shuttle flight.

In 1981, Deere became the first private company to sign a Technical Exchange Agreement with NASA. That agreement permitted the company to perform cast iron solidification experiments on board conventional suborbital NASA aircraft, which simulate microgravity for 30 to 60 seconds.

The design work on a series of additional metallurgical tests is already underway at Deere, where engineers are using data from the low gravity tests conducted earlier. Based on this work, Deere and NASA engineers have concluded that further experimentation would be productive.

The Shuttle tests would permit Deere to conduct experiments in space for longer periods of time than just seconds or minutes. This additional testing in near-zero gravity environment could yield new information to aid in the search for stronger irons. It also could provide new data about the process for forming iron molecules, leading to improved foundry efficiencies.

Signing of the memorandum of understanding is an interim step toward placing the Deere tests aboard a Shuttle in orbit.

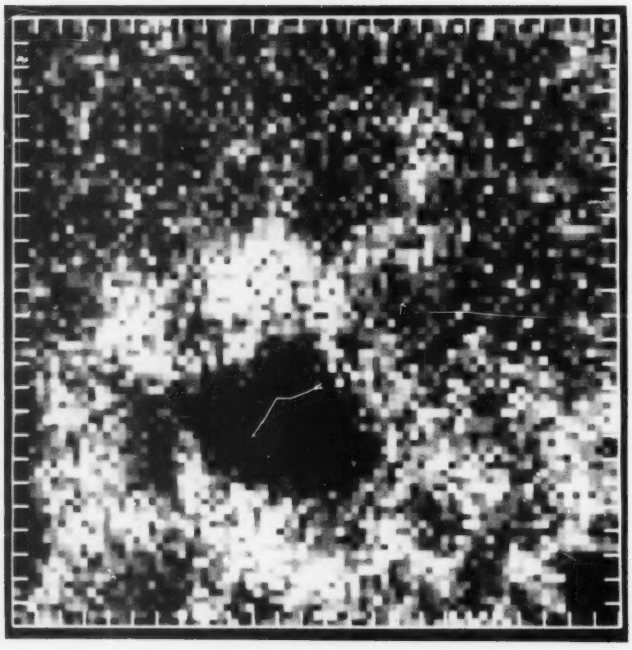
The memorandum is expected to lead to a Joint Endeavor Agreement between Deere and NASA under which the Shuttle tests would be carried out. It is estimated that several months work will be needed to design the tests before NASA and the company are ready to sign the agreement.

Contractor News

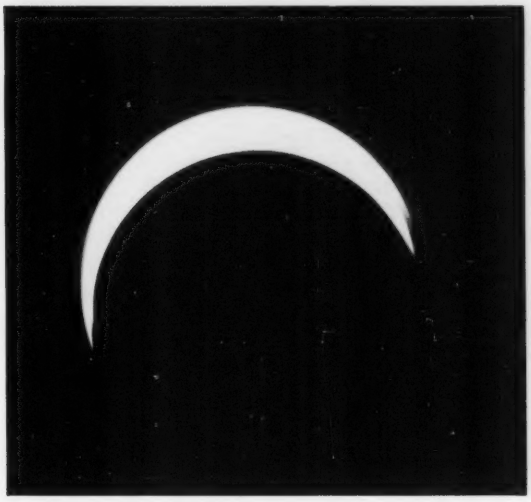
Lewis Research Center, Cleveland, Ohio, has selected **Analex Corp.**, Washington, D.C., for negotiations leading to the award of a contract with an estimated value of $19 million. The contract calls for the firm to provide specialized engineering and operational support for the Atlas/Centaur, Shuttle/Centaur, Atlas-H and advanced space communications programs. The contract is to run for three years with two one-year options at $6 million per year. Under the new contract, Analex will provide systems design and testing, performance analysis, structural testing, flight dynamics, integration studies, advanced studies, software development and other general support for the programs indicated. The majority of the work will be performed at Lewis.

Kennedy Space Center, Fla., has awarded a contract for $3,712,465 to **Martin Marietta Aerospace Corp.**, Denver, Colo., for a new communications system linking Space Shuttle Launch Complex 39 facilities. The contract includes an option to extend the new system to the KSC Industrial Area at a cost of $2,712,142. Under the contract, Martin Marietta is to design, develop, manufacture, integrate and test a high capacity, multichannel, digital electronic communications system to replace the LC-39 segment of the analog network now in use. Space Shuttle Mobile Launcher Platform No. 3 and its support at pads 39-A and 39-B, the Launch Control Center and Vehicle Assembly Building will be linked by the new system. The new system will use the latest technology for fiber optical cable and radio frequency communications to roughly double the number of available channels. It will also be less susceptible to noise and have lower maintenance costs than the existing system, which is now approximately 20 years old.

A $4.2 million contract has been awarded to **Datacom, Inc.**, Fort Walton Beach, Fla., for the replacement of the data processing system at Goddard Space Flight Center's Wallops Flight Facility, Wallops Islands, Va. The $4,242,538 fixed-price contract, scheduled for completion in November 1986, calls for the purchase of five computer systems having independent operational capabilities while at the same time being networked. These systems will provide data processing support for aeronautical, space and environmental research experimentation as well as administrative data processing support. In addition to the above computer system, the contract will provide a realtime interface and display system, a realtime system program, hardware/software training and systems maintenance.



FIRST ULTRAVIOLET IMAGE of an active region taken with the Ultraviolet Spectrometer and Polarimeter instrument on Solar Max. The dark area is a sunspot surrounded by bright structures which are areas of increased temperature and density in the upper solar atmosphere. The field of view is about 100,000 miles across. The image, made at 1:50 a.m. EST, April 27, was among the first provided by Solar Max since being restored to duty by the STS 41-C astronauts.



LAST ANNULAR ECLIPSE OF THE CENTURY—Enroute to annular eclipse on May 30, the moon covers 80 percent of the solar disk. Below, Walt Fountain (seated) and Charles Sisk of Marshall Space Flight Center's Space Science Laboratory, view a 93 percent eclipse at the center's observatory in Huntsville, Ala.

What's New in NASA Television and Radio Programming

Programs released in May:

Television

Aeronautics & Space Report (4½ minutes):

Advanced Propeller Research

Storm Hazards Research (also released in 90 second versions)

Radio

Space Story (4½ minute programs):

A Revolution in the Pharmaceutical Business (featuring James Rose, McDonnell Douglas Corp.)

On our Way to Uranus and Neptune (featuring Dr. Ed Stone, California Institute of Technology)

Space Trolling (featuring Georg Von Tiesenhausen, Marshall Space Flight Center)

Multi-blade Turboprop (featuring Bob Jeracki, Lewis Research Center)

Special Report (14½ minute programs):

Separating Biological Materials in Space (featuring Dr. James Rose, McDonnell Douglas Corp.)

Copies of television tapes are sent simultaneously to all NASA Visitor Information Centers and Public Affairs Offices, and to 650 television stations nationwide as well as to 425 cable television systems via the satellite RCA-Cablenet 1. Five hundred television stations receive material formatted as a 4½-minute program; the remaining 150 stations receive a 90-second "spot" — a condensed version of the 4½-minute presentation.

NASA's radio programs are sent to approximately 3,500 radio stations across the nation; in addition, translations of the recordings are made by Voice of America and Radio Free Europe and these tapes are then released to the appropriate audiences overseas. Released each month are one report of 14½ minutes and four 4½-minute weekly stories (one story in the set is featured for one week of the month). Ten one-minute space notes are released quarterly.

1984 Launch Activity

Space Shuttle Launches

Date	Mission	Orbiter	Launch Site*	Remarks
Feb. 3	41-B	Challenger (OV-099)	KSC	Payload: SPAS-01A, Palapa B-2, Westar-VI; successful launch; landing at KSC, Feb. 11.
April 6	41-C	Challenger (OV-099)	KSC	Payload: Solar Maximum Repair Mission; Long
Aug. 29	41-F	Discovery (OV-103)	KSC	Payload: Telstar 3-C, SBS-D, Syncom IV-2, SPARTAN-1
Oct. 1	41-G	Challenger (OV-099)	KSC	OSTA-3; ERBS
Nov. 2	51-A	Discovery (OV-103)	KSC	Payload: MSL-1, Telesat-H, GAS Bridge
Dec. 9	51-C	Discovery (OV-103)	KSC	Payload: DOD Mission

Satellite Deployments from the Shuttle

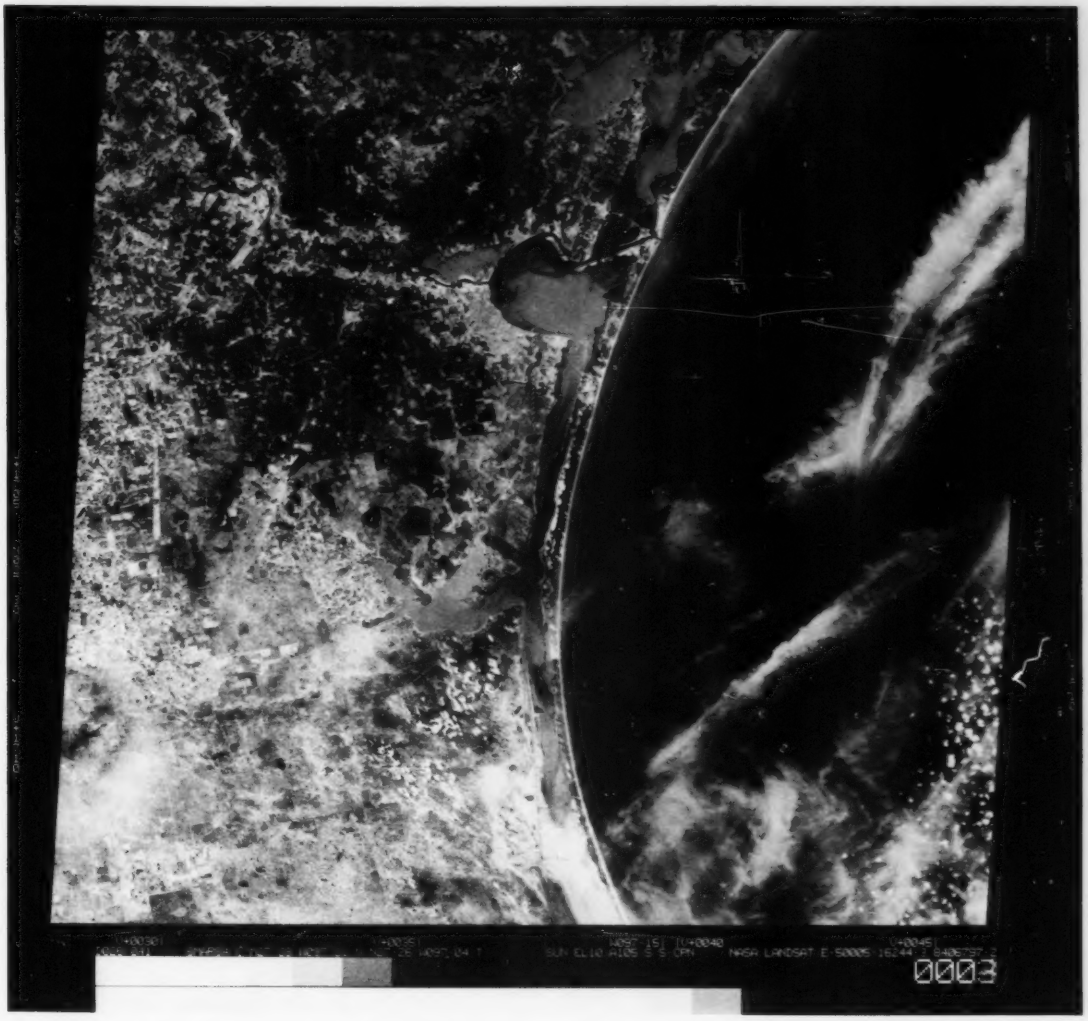
Date	Satellite	Deployment Device/** Upper Stage	Shuttle Mission	Remarks
Feb. 3	Westar-VI	PAM-D	41-B	Western Union communications; successful deployment from STS 41-B; satellite failed to achieve geosynchronous orbit.
Feb. 6	Palapa B-1	PAM-D	41-B	Indonesia communications; successful deployment from STS 41-B; satellite failed to achieve geosynchronous orbit.
April 7	LDEF	RMS	41-C	Long Duration Exposure Facility; successful deployment.
June 23	Syncom IV-1	UUS	41-D	Hughes communications
Aug. 29	SBS-D	PAM-D	41-F	Satellite Business Systems commercial communications
Aug. 30	Syncom IV-2	UUS	41-F	Hughes communications
Aug. 31	Telstar 3-C	PAM-D	41-F	AT&T communications
Oct. 1	ERBS	RMS	41-G	Earth Radiation Budget Satellite
Nov. 2	Telesat-H	PAM-D	51-A	Canadian communications

Expendable Launches

Date	Mission	Launch Vehicle	Launch Site	Remarks
March 1	Landsat 5	Delta	WSMC	National Oceanic and Atmospheric Administration; earth observation; successful launch.
June 9	Intelsat V-G	Atlas Centaur	ESMC	Intelsat international communications
August	NOAA-F	Atlas-F	WSMC	National Oceanic and Atmospheric Administration weather satellite
August	Intelsat VA-A	Atlas Centaur	ESMC	Intelsat international communications
Aug. 2	AMPTE	Delta	ESMC	Active Magnetospheric Particle Tracer Explorer; space physics—NASA cooperative with Germany
September	NATO-IIID	Delta	ESMC	North Atlantic Treaty Organization communications
November	Intelsat VA-C	Atlas Centaur	ESMC	Intelsat international communications
December	San Marco D/L	Scout	SMR	International cooperative with Italy
4 Qtr.	AF-16 (ITV-1)	Scout	WFF	U.S. Air Force

* **Launch Sites:** ESMC—Eastern Space and Missile Center, Fla.; KSC—Kennedy Space Center, Fla.; SMR—San Marco Range, Indian Ocean; WFF—Wallops Flight Facility, Wallops Island, Va.; WSMC—Western Space and Missile Center, Vandenberg Air Force Base, Calif.

** **Separation Device/Upper Stage:** IUS—Inertial Upper Stage; PAM-D—Payload Assist Module; RMS—Remote Manipulator System; UUS—Unique Upper Stage



SOUTHERN GULF COAST OF TEXAS—This Thematic Mapper image was the first received by Landsat-5 on March 6, 1984, one day after the four reflective spectral bands of the instrument were turned on. The 30-meter resolution of the Thematic Mapper permits many geographical features of the area to be seen in great detail. The right portion of the scene is the Gulf of Mexico. Between the mainland and the Gulf are a string of barrier islands (running north to south). St. Joseph (San Jose) Island terminates at the break of Arkansas Pass just north of Corpus Christi Bay (bear-headed shape). The City of Corpus Christi stretches along the southern shore of the bay. The other island shown is Padre Island on the National Seashore. In the vee formed by the two northern arms of Baggin Bay, Alazan Bay and Cayo del Grullo, lies the famous King Ranch. Landsat-5 was launched by NASA for the National Oceanic and Atmospheric Administration (NOAA) on March 1 from the Western Space and Missile Center at Vandenberg Air Force Base in California.

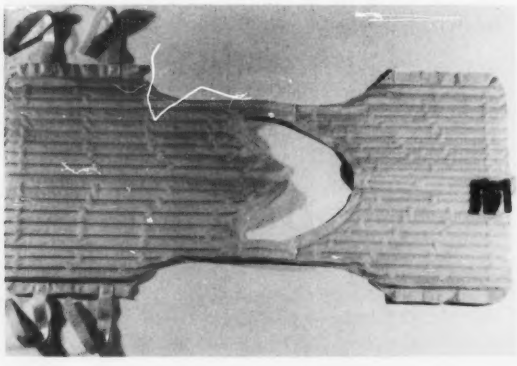
Another Dividend from Air and Space

Research and development in aeronautics and space have provided numerous benefits for all Americans — and at a tiny percentage of the tax dollar. Here is an example:

Cooling Vest

At right, a handicapped person is wearing a cooling vest developed by Ames Research Center to meet a special need of quadriplegics, who are often unable to tolerate heat stress because of their inability to perspire below the level of spinal injury. This condition restricts their activity outside of temperature controlled environments; thus the vest allows their participation in a range of outdoor activities in hot weather that would otherwise be denied them. Shown in closeup below, the vest is an adaptation of technology developed at Ames for thermal control garments used to remove excess body heat of astronauts wearing space suits.

Now being evaluated at the Palo Alto (California) Veterans Administration Hospital, the vest incorporates a series of corrugated channels through which cooled water circulates. It has a three-ply construction including two outer layers of urethane-coated nylon, heat-sealed to form the flow pattern, and a third internal layer of synthetic material woven to form a three-dimensional corrugated structure that conducts the flow of water. The vest is connected by inlet/outlet tubes to a compact cooling unit, worn as a backpack or affixed to the back of a wheelchair. The unit includes a



rechargeable battery, a mini-pump, a two-quart reservoir and a heat sink to cool the water; the heat sink can be a block of ice or a number of chemical frozen packs. A mechanical valve/sensor controls the water flow and keeps the temperature at a constant 68 degrees. In addition to its aid to quadriplegics, the system can be used by ambulatory patients who have heat control problems and it is suitable for industrial applications where personnel cooling is necessary.

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* NASA does not endorse commercial products developed as a result of its Technology Utilization or Patent Licensing Programs, but it does encourage the widest possible use of its technology.

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